MOBILE EXPERTS

**EXPERT INSIGHT FOR HANDSET SUBSCRIBERS**

# The illusion of Speed:

# Why 5G is not necessarily faster than 4G

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**Executive Summary**

Some things are so obvious that they are not even discussed in the mobile industry. Hey, 5G will be faster than 4G, and everybody wants faster phones. End of story, right? Well, no.

In short, the perceived speed of a mobile phone is governed by computing tasks, not by communications. As 4G has increased data speeds, loading a webpage is much quicker than our previous 3G experience. In fact, loading the content is now much faster than the time required to launch an application.

Strategically, this is an important shift. It means that wireless connection speed will not drive differentiation in the handset market anymore. Also, end users are likely to be disappointed when they buy a 5G phone with "faster speed" and then discover that launching an app or streaming can still have problems.

**This is like the PC market in the '90s**

In the days of the 286, 386, and 486 PC, the clock speed of the PC was so important that the PC manufacturers started to display the clock speed on the front panel. Anybody old enough to have bought computers in the 1990s remembers shopping according to clock speed.


But after the Pentium chip arrived and clock speeds reached a level of roughly 1 GHz, consumers stopped comparing PCs according to their clock speed. Clock speed didn't matter anymore! The amount of RAM and other details of the hard drive/software configuration became more important in everyday tasks.

This analogy is very relevant today. At roughly 30 Mbps for LTE, a webpage loads almost instantly, and the end user notices the delay in launching the app, not the delay in waiting for the content.

**Data speed was more important 20 years ago**

It's true that in the old days of 2G and 3G, waiting 30 seconds for a photo to load was actually commonplace. But things have changed dramatically… and today with a typical LTE network, a 50 kB photo can load almost instantly.

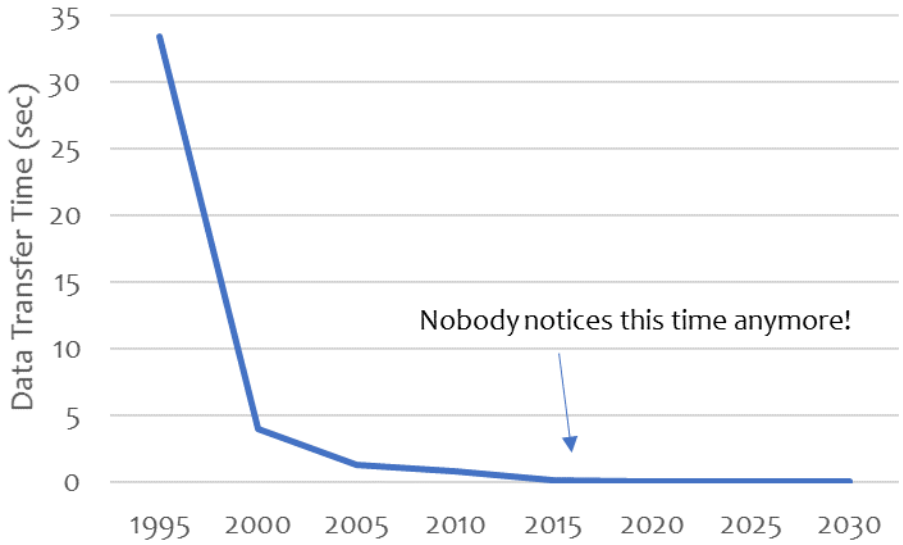


**Figure 1: Time required to download a 50 kB webpage over mobile networks**

Sources: Mobile Experts

**Analyzing speed for launching applications**

So, why do people have a perception that smartphones are "slow"? Well, because at times they are unacceptably slow to display useful information. It has to do with the time to load and launch applications, as well as computing and retrieving info from the cloud. While the LTE network latency can be 15-50 milliseconds in various locations, launching an app can take 4-5 seconds.

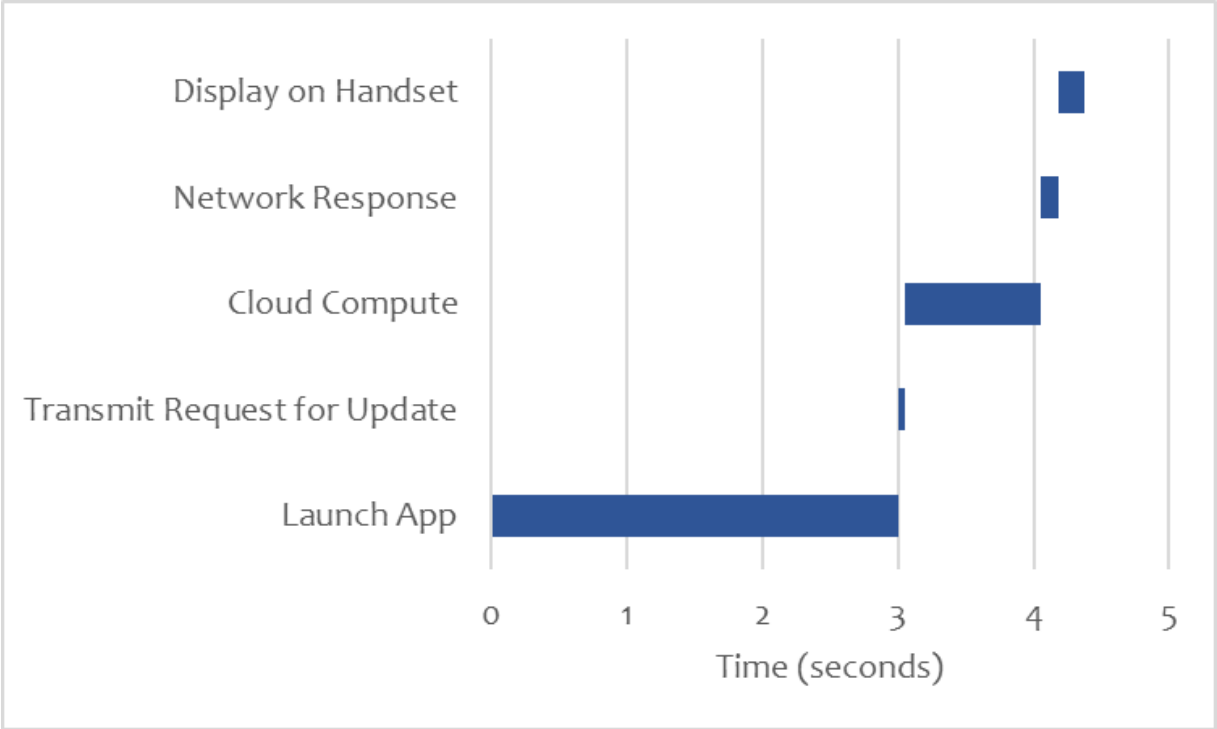


**Figure 2: Time to load a typical application on an LTE network**

Sources: Mobile Experts

In our example above, the LTE latency accounts for a total of 180 milliseconds (50 milliseconds for a small message in the uplink to retrieve data, followed by a download of about 50 kB). But the end user is waiting for more than four seconds to see useful information appear on his screen. Nobody in the mobile industry should be saying that "we need faster phones" without fully understanding this.

**Analysis of various applications**

In the example shown in Figure 2, we chose a "typical application". Here are some examples to illustrate how this example is fairly average:

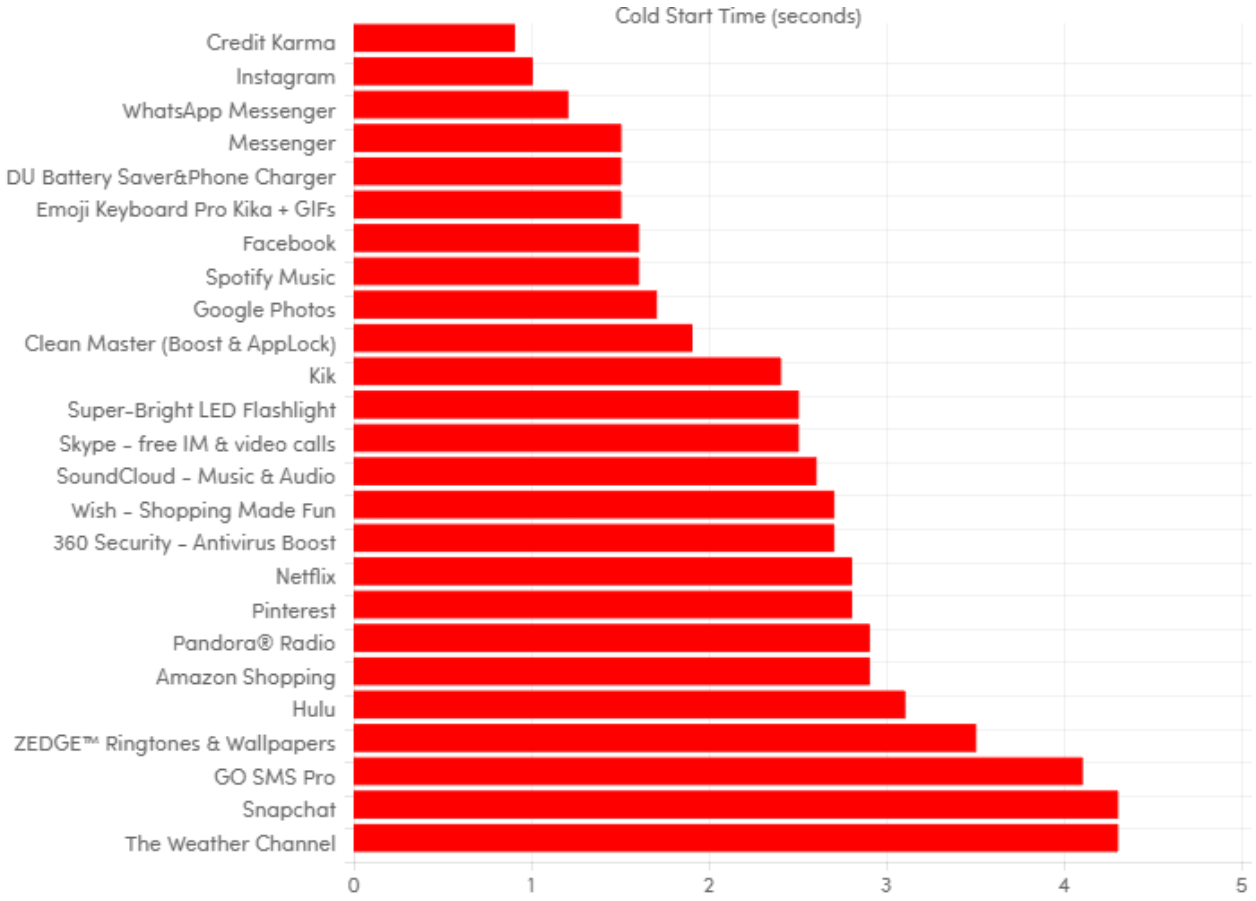


**Figure 3: Application cold start times in 2016**

Sources: NimbleApp

We used these reference points from NimbleApp as a starting point, but then we did some testing of our own in January 2019:

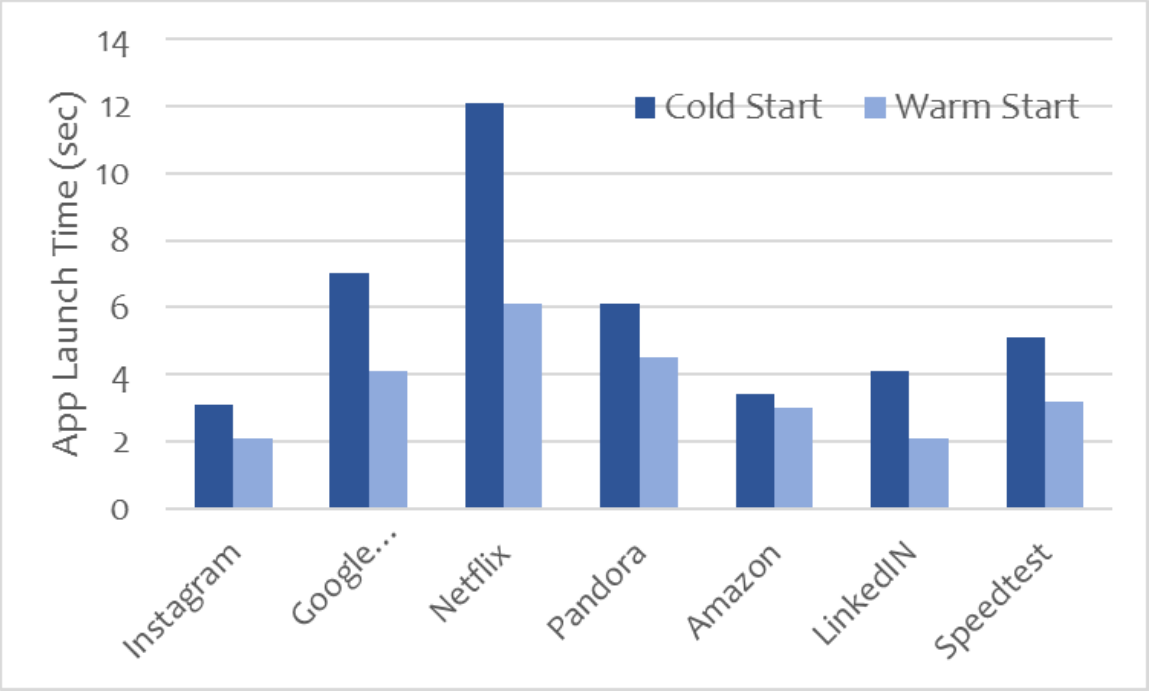


**Figure 4: Application cold start times in 2019**

Sources: Mobile Experts. Using Android/Samsung Galaxy S7

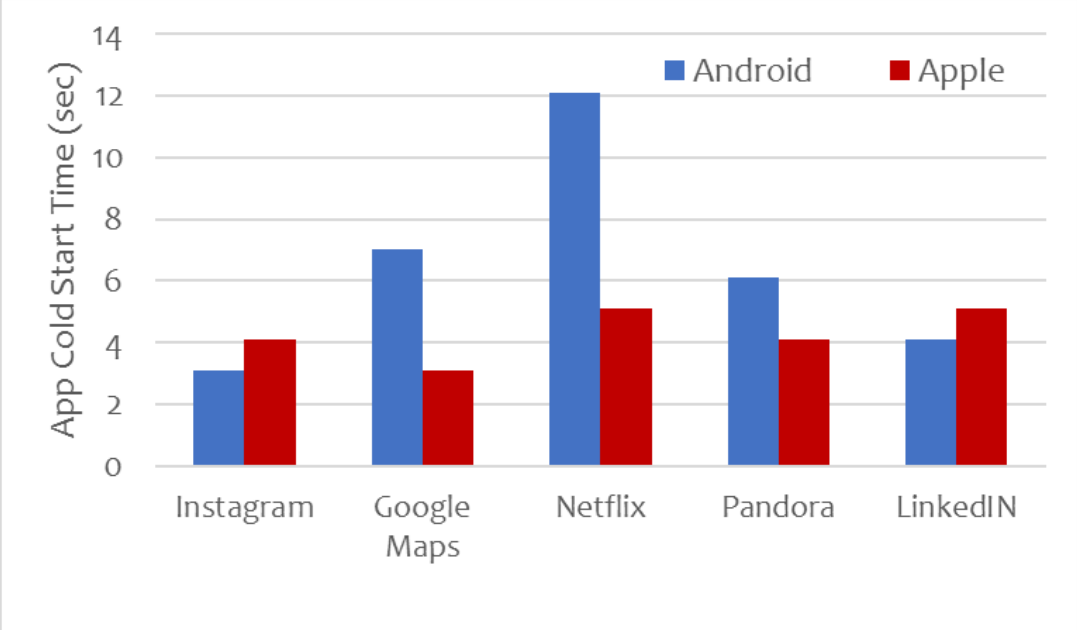


**Figure 5: Application cold start times, Android vs Apple**

Sources: Mobile Experts. Using Android/Samsung Galaxy S7 and iPhone 8, both on Verizon Wireless

We did not test the newest handsets along with the newest versions of each app, so we're not ready to conclude that application launch time is actually getting longer. But the NimbleApp data from 2016 actually appears to be optimistic, compared to our real-life experience in January 2019.

**Implications for 5G**

Launching applications are one important use case. What about video streaming? In theory, if the LTE network doesn't have high enough speed to fill the video buffer, then the end user will have to wait for the buffer to fill again. This is among the most aggravating use cases for consumers.

Our question is whether 5G will actually improve on keeping the buffer full. If network capacity is the issue, then the additional capacity offered by 5G network upgrades will most definitely help. But if the video buffer runs dry because of coverage issues, then 5G won't help.

In either case, gigabit speed is not important for video streaming, even in a world with augmented reality. HD Video requires a consistent stream at about 15 Mbps, and 4K video can run as high as 25 Mbps. AR might extend things to 100 Mbps in some cases… but any higher-level VR applications are fixed scenarios, not mobile scenarios. Our point is that streaming does NOT require 500 Mbps or higher.

Reliable statistics are not available in this case… so at this time we can't make precise estimates for how many consumers will notice an improvement in video services with 5G. Our anecdotal data suggest that about half of buffering issues come from lack of capacity in the network, and the other half from coverage issues. That means that about half of these issues would be resolved by adding capacity, whether it's LTE capacity (small cells, massive MIMO, new bands) or 5G capacity.

The other half of video streaming problems related to poor coverage will not be improved by an investment in 5G.

**File Synchronization or Big Downloads**

To illustrate an example of an end-user scenario that really needs 5G speeds, we have to choose some fairly uncommon cases. Dropbox or photo-sharing cloud services can require some extensive file synchronization, and when a user sets up a new account or makes a major change, the system can require upload or download of hundreds of gigabytes. Movie downloads can consist of files in the range of 4-5 GB.

In these cases, speed is important, and 5G would have a noticeable improvement over 4G. But our view is that these use cases are not common enough to satisfy the consumer. Everyday file sharing and entertainment do not include multi-gigabyte downloads. This might become more common over time, but we don't believe that the mainstream market is moving in the direction of downloading big files routinely… streaming of smaller bits of content is the current trend.

**Implications for our 5G forecast**

There's a major mismatch between user desire ("I want a faster phone") and the actual improvement introduced by 5G. In most cases, the consumer's complaints about slow speed will not be addressed by 5G, because the delay is simply not related to the raw speed of a wireless link.

So, the industry is at risk here. We are likely to disappoint our customers: promising faster speed, and then not delivering an improvement. For this reason, we are NOT forecasting a major uptick in handset sales with 5G.

**What will mobile operators do?**

The train wreck is coming. In slow motion, we are watching as mobile operators trumpet the faster speeds for 5G in their TV ads, and at the same time we know that the data speed won't impact at least three-quarters of the use cases that matter.

We believe that mobile operators and handset OEMs will learn the realities of speed and consumer perceptions the hard way during 2019 and 2020, and start positioning 5G in a different way. 5G will create cost savings for the operator, and as we add new 5G bands we will add capacity. Assuming that consumers don't jump to upgrade quickly to 5G, the operators will be forced to incentivize them.

We believe that the operators will eventually need to subsidize consumer upgrades to 5G. Will they give away free 5G phones? Will 5G mm-wave be embedded in the smartphone, or will the operators give away free 5G mm-wave hotspots? Today, we don't know what form the incentives will take. But we see billions of dollars of savings in the use of 5G and massive MIMO networks, because these new techniques are much more cost-effective than LTE. For a subscriber using 10 GB per month, 5G is likely to save roughly $10 per month in the raw cost of delivering data. Therefore operators can partially subsidize a high-level smartphone simply based on network cost savings.

In the end, we believe that operators are likely to offer partial subsidies for 5G smartphones, especially where 5G is implemented below 6 GHz and the additional handset cost is low. In the United States, where 5G will be deployed first in mm-wave bands, operators are also likely to give away free mm-wave hotspots, to move selected heavy users onto the 5G service.